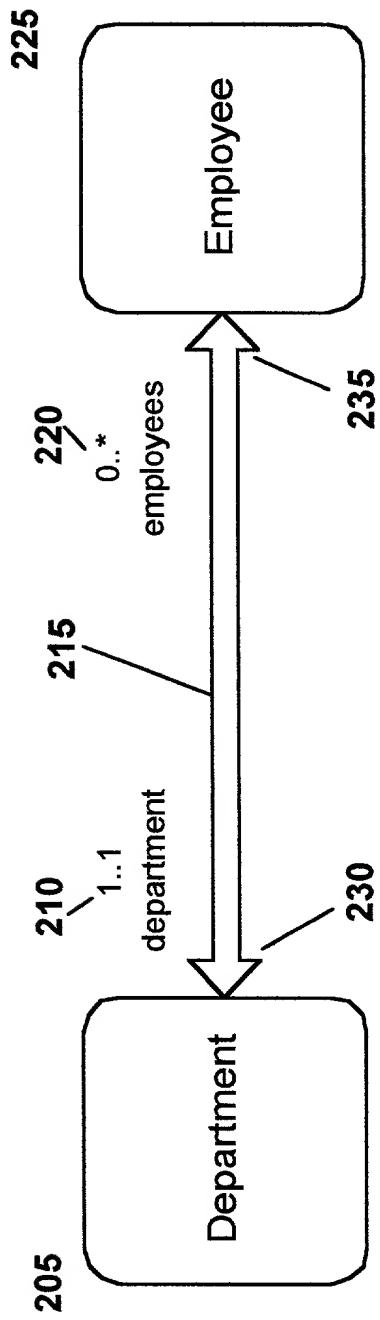


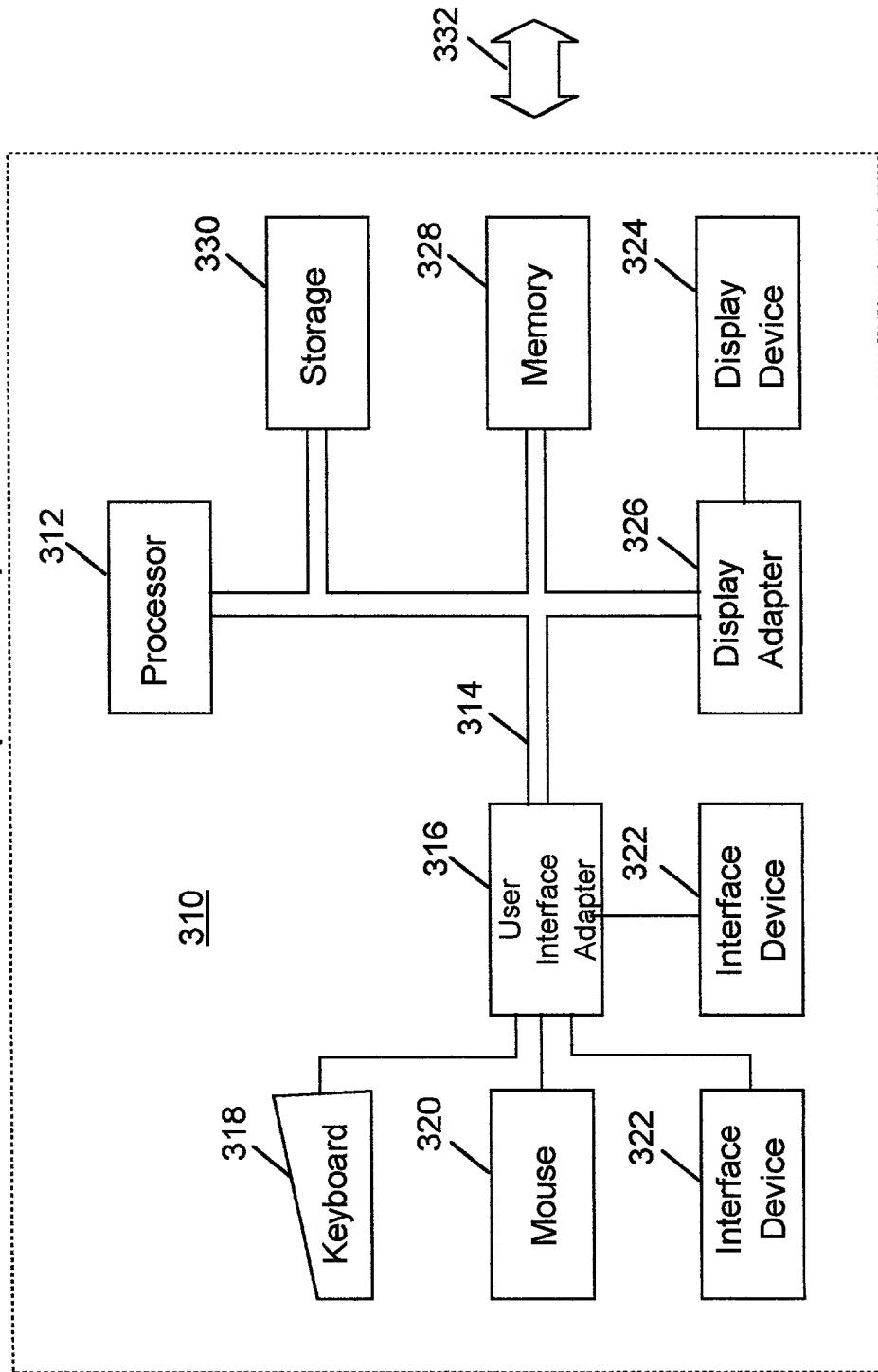
**FIG. 1A**  
**(Prior Art)**

**FIG. 1B**  
**(Prior Art)**

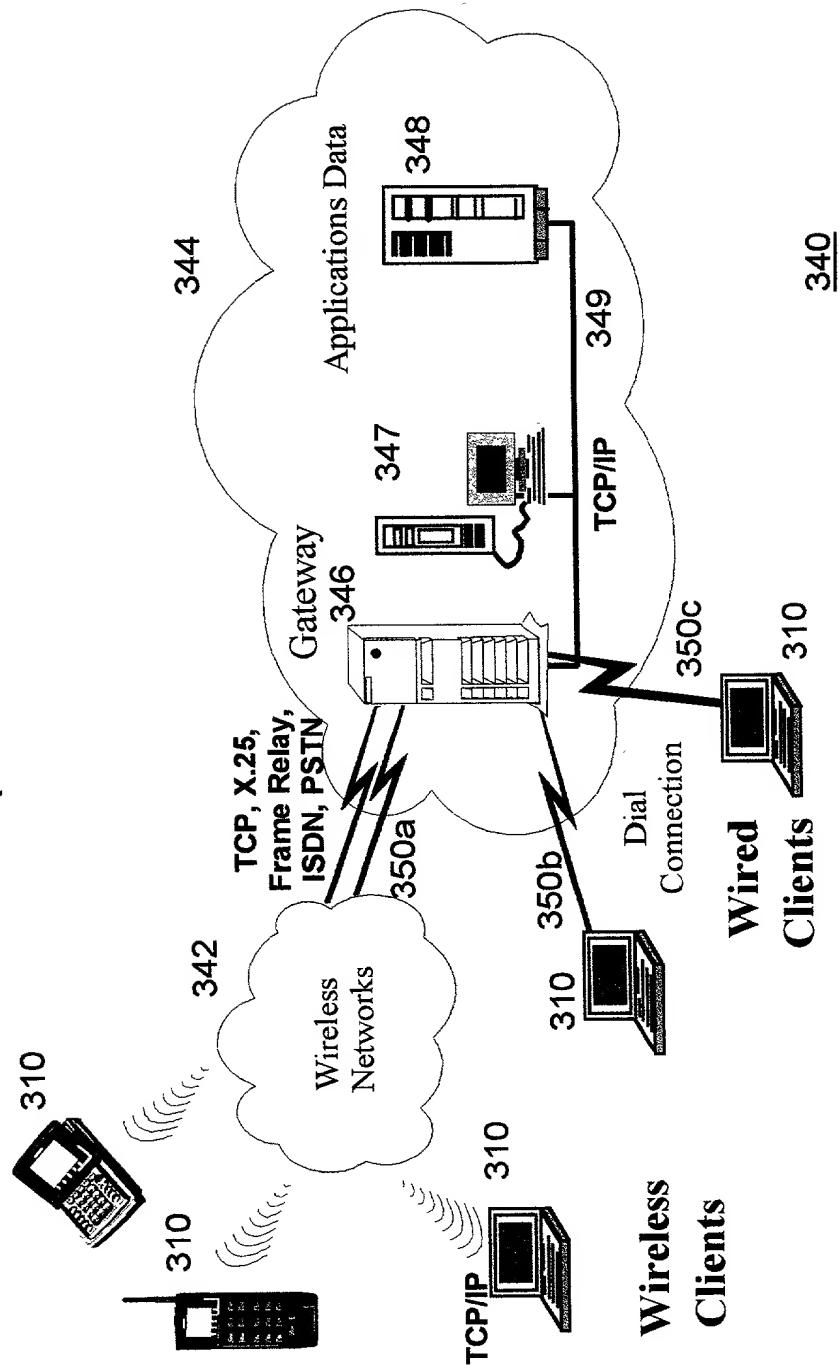


**FIG. 2**

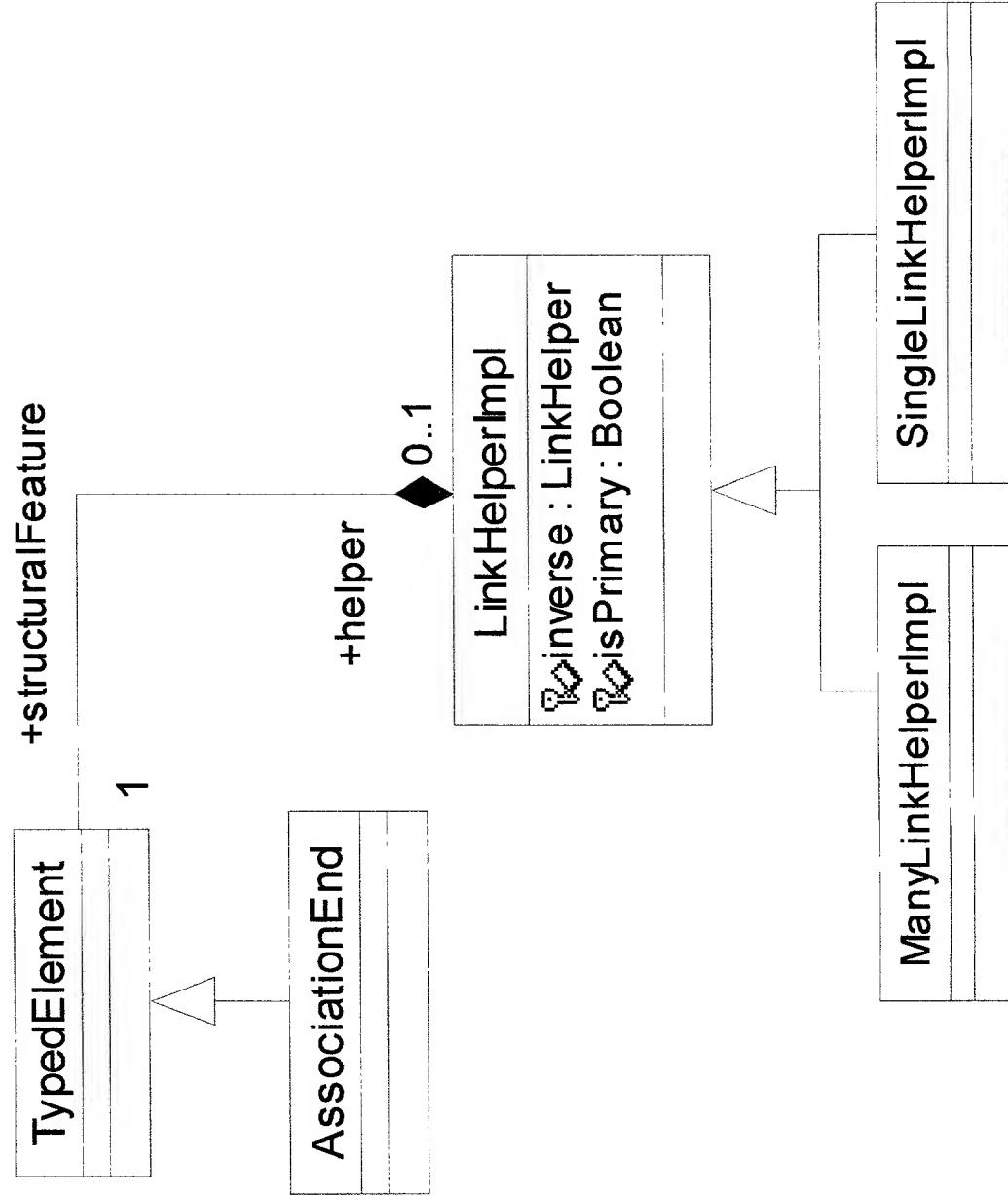
**FIG. 3 (Prior Art)**



**FIG. 4**  
**(Prior Art)**



**FIG. 5**



**FIG. 6**

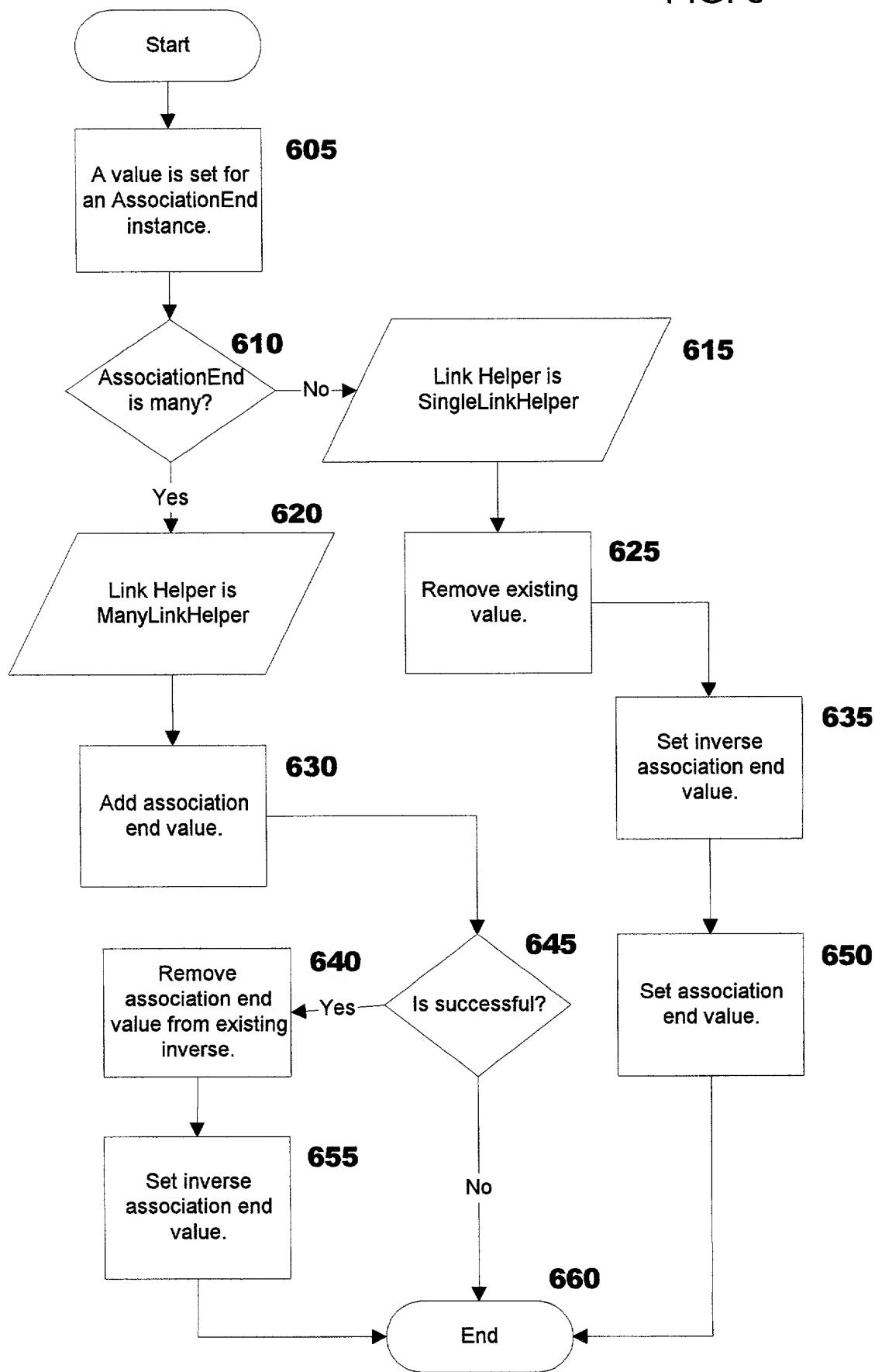


FIG. 7

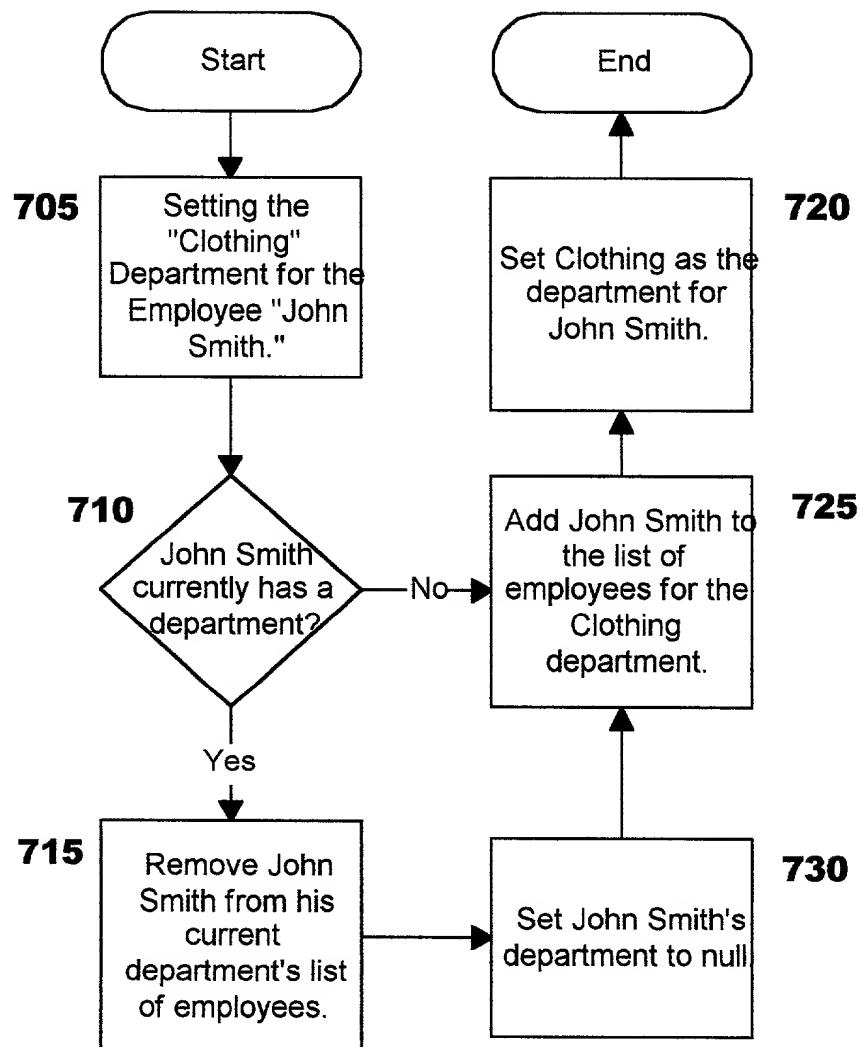
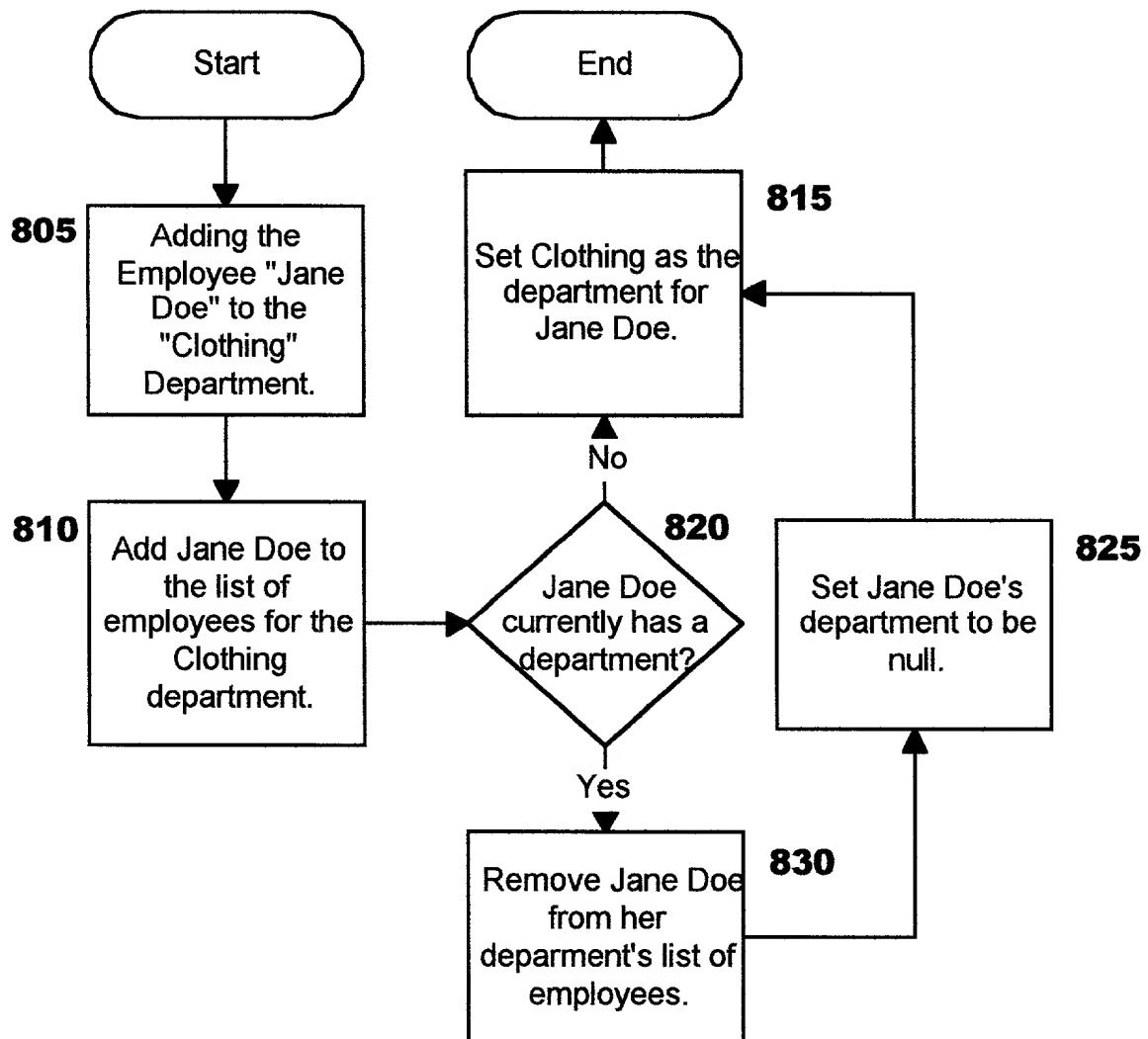


FIG. 8



**900**

```

<?xml version="1.0" encoding="UTF-8"?>
<XML xmi.version="1.1" timestamp="Mon Sept 20 16:13:08 EST 2000" xmlns:mof="schemas/MOF.xmi">

<XML.header>
  <XML.model xmi.name="Company"/>
</XML.header>
<XML.content>
  <mof:Package xmi.id="Company" name="Company">
    <mof:Namespace.contents>
      <mof:Class xmi.id="Department" name="Department">
        <mof:Namespace.contents>
          <mof:Attribute xmi.id="Department_name" name="name">
            <mof:TypedElement.type>
              <mof:DataType href="schemas/mof.xmi#String"/>
            </mof:TypedElement.type>
          </mof:Attribute>
        </mof:Namespace.contents>
      </mof:Class>
      <mof:Class xmi.id="Employee" name="Employee">
        <mof:Namespace.contents>
          <mof:Attribute xmi.id="Employee_LastName" multiplicity="1..1" name="lastName">
            <mof:TypedElement.type>
              <mof:DataType href="schemas/mof.xmi#String"/>
            </mof:TypedElement.type>
          </mof:Attribute>
          <mof:Attribute xmi.id="Employee(firstName" multiplicity="1..1" name="firstName">
            <mof:TypedElement.type>
              <mof:DataType href="schemas/mof.xmi#String"/>
            </mof:TypedElement.type>
          </mof:Attribute>
        </mof:Namespace.contents>
      </mof:Class>
    </mof:Namespace.contents>
  </mof:Package>
</XML.content>

```

**FIG. 9A**

<b>FIG. 9A</b>
<b>FIG. 9B</b>

**FIG. 9**

**FIG. 9B**

```
<mof:Attribute xmi:id="Employee_title" multiplicity="1..1" name="title">
  <mof:TypedElement.type>
    <mof:DataType href="schemas/mof.xmi#String"/>
  </mof:TypedElement.type>
</mof:Attribute>
<mof:Namespace.contents>
</mof:Class>
  <mof:Association xmi:id="DepartmentToEmployees" name="DepartmentToEmployees">
    <mof:Association.associationEnds>
      <mof:AssociationEnd xmi:id="DepartmentToEmployees_employees" multiplicity="0..*"
        name="employees" aggregation="COMPOSITE" type="Employee"/>
910
      <mof:AssociationEnd xmi:id="DepartmentToEmployees_department" multiplicity="1..1"
        name="department" aggregation="NONE" type="Department"/>
    </mof:Association.associationEnds>
  </mof:Association>
</mof:Namespace.contents>
</mof:Package>
</XMI.content>
</XMI>
```

**FIG. 10**

The diagram illustrates the XML structure of a Company model. The XML code is as follows:

```
<?xml version="1.0" encoding="UTF-8"?>
<XML xmi.version="1.1" timestamp="Mon Oct 20 16:16:25 EST 2000"
  xmlns:mof="schemas/MOF.xmi" xmlns:Company="schemas/company.xmi">
<XML.header>
<XML.model xmi.name="Employees"/>
<XML.metamodel xmi.name="mof" xmi.version="1.0" href="schemas/MOF.xmi"/>
<XML.metamodel xmi.name="Company" xmi.version="1.0" href="schemas/company.xmi"/>
</XML.header>
<XML.content>
  />
<Company:Employee xmi.id="E003" firstName="John" lastName="Smith" title="Staff"/>
<Company:Employee xmi.id="E005" firstName="Jane" lastName="Doe" title="Staff"/>
</XML.content>
</XML>
```

Annotations are present in the XML structure:

- 1000** is underlined and placed next to the opening tag of the XML document.
- 1010** is placed next to the closing tag of the XML header section.
- 1020** is placed next to the closing tag of the XML content section.

**FIG. 11**

```
1100 <?xml version="1.0" encoding="UTF-8"?>
<XML xmi.version="1.1" timestamp="Mon Oct 20 16:16:25 EST 2000"
      xmlns:mof="schemas/MOF.xmi" xmlns:Company="schemas/company.xmi" xmlns:Employees="employees.xmi">
<XML.header>
<XML.model xmi.name="Figure 7 Before"/>
<XML.metamodel xmi.name="mof" xmi.version="1.0" href="schemas/MOF.xmi"/>
<XML.metamodel xmi.name="Company" xmi.version="1.0" href="schemas/company.xmi"/>
</XML.header>
<XML.content>
<Company:Department xmi.id="Clothing" name="Clothing"/> 1110
<Company:Department xmi.id="Shoes" name="Shoes"> 1120
  <Company:Department.employees>
    <Company:Employee href="employees.xmi#E003"/> 1130
  </Company:Department.employees>
</Company:Department>
</XML.content>
</XML>
```

**FIG. 12**

**1200**

```
<?xml version="1.0" encoding="UTF-8"?>
<XMI xmi.version="1.1" timestamp="Mon Oct 20 16:16:25 EST 2000"
  xmlns:mof="schemas/MOF.xmi" xmlns:Company="schemas/company.xmi"
  xmlns:Employees="employees.xmi">
<XMI.header>
  <XMI.model xmi.name="Figure 7 After"/>
  <XMI.metamodel xmi.name="mof" xmi.version="1.0" href="schemas/MOF.xmi"/>
<XMI.metamodel xmi.name="Company" xmi.version="1.0" href="schemas/company.xmi"/>
</XMI.header>
<XMI.content>
  <Company:Department xmi.id="Clothing" name="Clothing">1210
    <Company:Department.employees>
      <Company:Employee href="employees.xmi#E003"/>
    </Company:Department.employees>
  </Company:Department>
  <Company:Department xmi.id="Shoes" name="Shoes"/>1220
</XMI.content>
</XMI>
```

**FIG. 13**

**1300**

```
<?xml version="1.0" encoding="UTF-8"?>
<XML xmi:version="1.1" timestamp="Mon Oct 20 16:16:25 EST 2000"
      xmlns:mof="schemas/MOF.xmi" xmlns:Company="schemas/company.xmi" xmlns:Employees="employees.xml">
<XML.header>
<XML.model xmi:name="Figure 8 Before"/>
<XML.metamodel xmi:name="mof" xmi:version="1.0" href="schemas/MOF.xml"/>
<XML.metamodel xmi:name="Company" xmi:version="1.0" href="schemas/company.xml"/>
</XML.header>
<XML.content>
<Company:Department xmi:id="Clothing" name="Clothing">
<Company:Department.employees>
<Company:Employee href="employees.xml#E003"/> 1310
</Company:Department.employees>
</Company:Department>
<Company:Department xmi:id="Shoes" name="Shoes">
<Company:Department.employees>
<Company:Employee href="employees.xml#E005"/> 1320
</Company:Department.employees>
</Company:Department>
</XML.content>
</XML>
```

1400

```
<?xml version="1.0" encoding="UTF-8"?>
<XML xmi.version="1.1" timestamp="Mon Oct 20 16:16:25 EST 2000"
      xmlns:mof="schemas/MOF.xmi" xmlns:Company="schemas/company.xmi" xmlns:Employees="employees.xmi">
<XML.header>
    <XML.model xmi.name="Figure 8 After"/>
    <XML.metamodel xmi.name="mof" xmi.version="1.0" href="schemas/MOF.xmi"/>
    <XML.metamodel xmi.name="Company" xmi.version="1.0" href="schemas/company.xmi"/>
</XML.header>
<XML.content>
    <Company:Department xmi.id="Clothing" name="Clothing">
        <Company:Department.employees>
            <Company:Employee href="employees.xmi#E003"/> 1410
            <Company:Employee href="employees.xmi#E005"/> 1420
        </Company:Department.employees>
    </Company:Department>
    <Company:Department xmi.id="Shoes" name="Shoes"/> 1430
</XML.content>
</XML>
```

**FIG. 14**

## FIG. 15

1. If the end is a composite aggregation (aggregation by value), it is the primary end.  
else
2. If an inverse exists and the inverse is a composite aggregation, then it is not the primary end.  
else
3. If the end is a shared aggregation (aggregation by reference), it is the primary end.  
else
4. If an inverse exists and the inverse is a shared aggregation, then it is not the primary end.  
else
5. If the end is navigable,  
5a. If an inverse exists and the inverse is navigable,
  - 5a1. If the inverse is already the primary end, then this end is not the primary end.  
else
  - 5a2. If the end's multiplicity is many (upper bound is greater than 1), then it is the primary end.

else

- 5b. This end is the primary end.